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Original Research Article

Analysis of Urban Design Subjects Associated with the Concept of "Linkage"*

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Abstract

Problem statement: Discussion in every discipline starts with a subject. For instance, medicine is associated with the human body, and the concern of physics is motion. Different disciplines also have their own subjects. So far, various definitions have been presented for urban design, and each definition introduces a subject. Urban design is faced with many subjects that indicate a lack of consensus on the subject of urban design. The subject of urban design is often taken from other fields, and fewer efforts have been made to explain the subjects in the scope of urban design. The main question is, what is the subject in urban design that no other profession can claim? By examining the definitions, the subjects were categorized into two groups: linkage and its sub-groups, as well as the constituent components of linkage (city and its components). Based on this, the research question would be: "How can urban design subjects related to the concept of "linkage" be analyzed?"

Research purpose: This study aims to identify the subject and sub-subjects in the field of urban design among the definitions of urban design and then analyze the subjects related to the concept of linkage.

Research method: In this research, quantitative and qualitative content analysis methods were used, and aligned with the general model of linkage theory, the theoretical model of linkage was remodified with the MAXQDA software.

Conclusion: By describing and etymologizing the hidden meanings in the subject words included in the definitions of urban design, it was determined that the subject of urban design is "The network of city linkages". The "Linkage" network at the first level of the city system is a subject of urban design and a set of "Linkage" networks at lower levels are sub-subjects of it.

Keywords: A*analysis, Subject, Linkage, Urban design, City*

Introduction

Urban design as a field filling the gap between architecture and planning emerged as an academic discipline in 1960. Since then, experts in this field have introduced urban design from their own perspective, and many different definitions have been presented. But still, in the definitions of urban design, the subject is ambiguous. In each definition, a different subject or subjects are identified. (subject-matter of each science is something whose existence (wuǧūd) is admitted in that science, and of which only the states (aḥwāl) are investigated (Alpina, 2021, 61)). The first subject raised in urban design was the quality of the city body. Later, it encompassed many other subjects such as aspects of urban form, characteristics of place and the patterns of movement in cities (Davis, 2022, 2), Decisions, functional and formal order in the physical environment (Bahrainy & Bakhtiar, 2022, 1), land use (Cowan, 2021, 2), public realm, material changes,

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politically relevant activity (Cozzolino et al., 2020, 7), sustainable development (Giudice et al., 2023, 105), a system around the project (Roggema, 2023, 122). In addition to the above subjects mentioned in some definitions, the terms "communication", "relationship", "interplay", "interaction", "problem" and "linkage" have been also mentioned in urban design definitions. For example, one can refer to the communication between the elements of a set, the concerns of different professions (Lang, 1994, ix), the relationship of new development to existing city form as much as to the social, political, and economic demands and resources available (Bahrainy & Bakhtiar, 2016, 6), interplay between our evolving environment of buildings and the values, expectations and resources of people (Madanipour, 1996, 104; Carmona, 1996, 58; DoE, 1994, 2), human interaction, economic exchange and well-being (Lara & Evans-Cowley, 2016, 264), creative problem-solving (Kasprisin, 2020, 4), the linkage between city goals and city plan with physical-spatial nature (Bahrainy, 2014, 60). Urban design is an activity field of urban planning that has witnessed the justification of knowledge integration and the unconditional addition of new subjects from other fields and in each period, according to the different conditions and needs of the society, the subject in urban design is changed according to necessity and attention is drawn to the new subject. This is while presenting urban design subjects with a specific structure indicates its significance. It is necessary to determine the subject before starting the process of designing the city. Considering the above-mentioned, the present study aims to carry out the analysis of urban design subjects emphasizing the concept of "linkage" to answer the following question: what is subject in urban design? And How can analysis of urban design subjects emphasizing the concept of "linkage" be performed?". To find the answer to this question, the definitions of urban design presented in various sources were extracted and the subjects raised in each definition were identified and analyzed with quantitative and qualitative content analysis methods.

Research Background

Experts and researchers in the urban design field have defined urban design from different angles, and urban design is still ambiguous: The multiplicity of definitions shows the need for a clear definition of urban design. A definition that introduces a unique subject of urban design and differentiates it from other disciplines. A classification of urban design definitions from birth to maturity is presented (Golkar, 2012). A group of definitions using boundaries and regions are provided (Greed, 1998; Carmona, 1998). Some definitions are focused on the product/process problem (Nase et al., 2015, 2; Bell, 2005, 372; Schurch, 1999, 15; Reicher, 2022, 2). In other definitions, attention has been paid to its connection with the gap between construction, environment, architecture, and city planning (Bahrainy, 2014, 30; Inam, 2014, 9 Carmona, 2014, 3; Moor & Rowland, 2006, 20; Cuthbert, 2007, 181). Definitions have paid attention to the city and some of its aspects and components (Alvarez, 2023, 44; Cushing & Miller, 2020, 26; Duan & Liu, 2022, 138; Birkeland, 2020, 37). In other attempts to define urban design, various foci are seen: some deal with areas of urban design, especially its engagement with the physical fabric of the city. Others have focused on its scale, its points of departure or relevance to planning and architecture, its political and management aspects, or its place in the planning process (Madanipour, 1997). It seems that in this recent case, the foci mean the same urban design subjects that have not yet been specifically and addressed in any urban design research. The plurality of the subject in the definitions of urban design goes to the extent that urban design borrows the subject from other disciplines or even introduces urban design as a part of architecture or planning, while urban design has a unique subject like other fields, and all propositions related to urban design (problem, theory, hypothesis, etc.) should be formed around the subject of its own. In previous research that introduced urban design, only some aspects of the subject have been paid attention to. Meanwhile, by analyzing the subject raised in the definitions, this research has coherently introduced the subject and sub-subjects in urban design.

Theoretical Foundations

- **Subject**

Subject is the most fundamental concept: it is the ground on which science is built, it confers unity upon science and distinguishes it from other sciences

(Alpina, 2021, 1). A subject is a sequence involving continuities and discontinuities, openings, and points (Badiou, 2009, xxvi). Modern philosophers come to understand how the ideas of the dialogue, taken together, may form a web of dialectical relations by which a wholly new substance may be explained: a subject (Carlson, 2005, 55). The subject of every science is the reality on which all propositions, problems, and theories of that science are based (Motahari, 2010, 7). The subject should be explained comprehensively so that no subject is left out of the scope of science and unrelated subjects are not included. The subject of science discusses it and solves its problems. The subject of every science is sought from its complications, which are carried over to a subject. Complications are divided into intrinsic and incidental. Each complication is an aspect of the nature of an existing. Nature is the form of beings and limits that are reflected in the mind. In this way, the chain of communication forms a single chain that continues until the first subject, which is the subject of science (Ebrahimi Dinani, 2020).

- **Linkage**

When talking of a system, one can refer to the proximity and location of the parts, the functions of the parts, the main goal(s) of the system, the levels nested in the system, and the interactions both between the parts and among the different levels. Complex systems are systems made of many connected and interacting parts (Fidanboy, 2022, 1 & 2). The linkage was proposed in the general and complex systems theory. Complex systems contain many linkages in many components. Complex networks can represent vastly different types of systems and the connections in a network may represent interactions of various kinds. In network models, the exact nature of the interactions may even be ignored. Complexity science always involves describing a system by describing the interactions and relations among its parts. In most complex systems, the interactions between the parts are of more than one kind (Ladyman & Wiesner, 2020, 6 & 7). The concept of linkage seems to carry more semantic loads (connotations) in systems research. This concept has been practically used with different degrees of accuracy in all the works trying to understand how systematic confrontation is. However, the wide application of this concept has made it less clear in terms of content (Baulberg et al., 1977). Linkage is an abstract theoretical plan that becomes necessary at the higher levels of knowledge synthesis, and it formulates interesting and debatable hypotheses about the paths of expanding knowledge to develop the principles of agency and the structure of complex issues (Reich & Benbasat, 1996).

Research Method

Content analysis was done with open coding, axial coding, and selective coding in MAXQDA software. By reviewing sources of urban design, definitions (content) were collected from 1953 to 2024 and the subjects raised in the definitions were unified in open coding. Classifying the subjects into units involved defining, separating, demarcating, and identifying them for content analysis. Definitions consist of the number of terms placed next to each other. The subject was separated and distinguished from other terms given in each definition. The interpretation of the terms communication, relationship, interplay, interaction, problem, and linkage as the subjects raised in the definitions of urban design, and then the content analysis of each one was carried out to determine their structures and the relationships between the above-mentioned terms with the concept of linkage according to the theoretical linkage model (axial coding). Next, the content of each category was investigated separately to discuss and interpret the content of the categories (selective coding) (Baulberg et al., 1977). The obvious content of subjects in definitions of urban design was deductively investigated through quantitative content analysis with a specific process including the following steps: the review of the linkage theory, formation of category, sampling, data collection, analysis, and interpretation (Riffe et al., 2024). Since in the quantitative content analysis, the terms in the definitions of urban design are analyzed separately with no relation to each other, qualitative content analysis was also carried out. Qualitative content analysis was carried out deductively (Tracy, 2020), by referring to the definitions of urban design, concepts and themes were gradually summarized in the definitions. In qualitative content analysis, the process mainly started from the text to the extraction of the "linkage and problem" category,

subcategories, and sub-subcategories, and then, to the creation of their conceptual models and maps.

Discussion

The determination of categories and how they are formed and organized are among the most important items investigated in qualitative content analysis. In this analysis, categories were extracted from the definitions of urban design and were used to organize concepts and themes in the form of meaningful sets. In the selection of categories, the internal elements of each category have meaningful similarities and there were perceivable differences between each two separate categories. Since the categories represent the principles governing the text, they are required to be as close to the text as possible in terms of meaning, so that the research results would face fewer deviations. For this purpose, three types of open, axial, and selective coding were conducted using MAXQDA software.

- **Open coding**

In open coding, definitions of urban design, whose subjects were linkage, problem, communication, relationship, interplay, and interaction were considered content. Each definition introduced a subject (subjects). The semantic affinity of the terms communication, relationship, interplay, and interaction with linkage and problem (unhealthy linkage) caused each of them to be separately interpreted and coded. According to the theoretical linkage model, in addition to the extracted subjects, the components as well as their functions were also coded. Open coding provided their frequencies (Table 1).

- **Axial coding**

In axial coding, the terms linkage and problem (unhealthy linkage) were considered categories. By examining the terms communication, relationship, interplay, and interaction, it was found that each of these refers to an aspect of linkage, and what is common among them is to establish a linkage between two components. So, they can be considered the subcategories of linkage. In the definitions extracted, in addition to the subjects mentioned and named as categories and subcategories in the axial coding, the components (material and immaterial) as well as their functions were coded as the sub-subcategories of sub-categories (Fig. 1).

- **Selective coding**

Selective coding examined the relationship between the "linkage" concept and its sub-categories and sub-sub-categories and determined the commonalities and differences between them, as described separately below (Table 2). Each subject implies the concept of linkage. The linkage is composed of two components, and the communication, relationship, interplay, interaction, or ratio between them (each of the city components can be considered a component) through the function(s) in the environment. This linkage may be unhealthy (disturbed communication, relationship, or ratio) and a problem may be raised. Understanding the structure of each led to the modification of the theoretical linkage model.

The subjects of urban design were identified through the content analysis of urban design definitions in MAXQDA software. Describing and etymologizing latent meaning in the terms raised as subjects in urban design definitions according to the theoretical linkage model indicated the similarities and differences between the identified subjects (Neundorf, 2017). The summary of each is presented separately below:

A: objective and subjective components

B: communication, relationship, interplay, interaction, linkage, problem

Table 1. The frequency of subjects raised in the definitions of urban design from 1953-2024 in open coding. Source: Authors.

Definitions of urban design	Subjects in definitions	Subjects related to linkage	Subject of communication	Subject of relationship	Subject of interplay	Subject of interaction	Subject of problem	Subject of linkage
648	2135	87	6	48	2	7	18	6

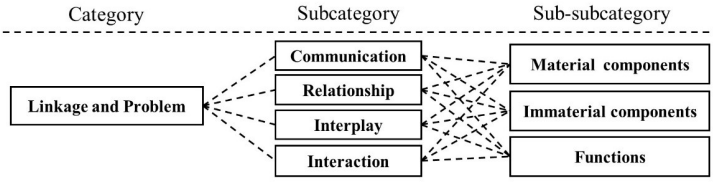
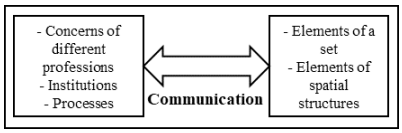
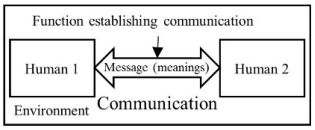
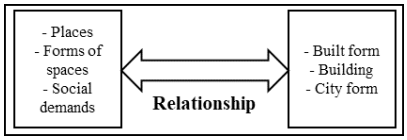
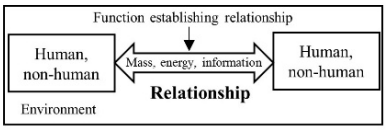
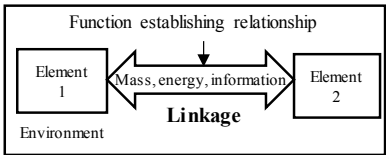
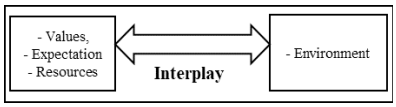
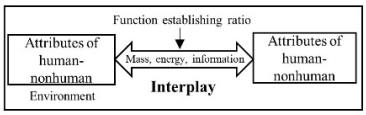
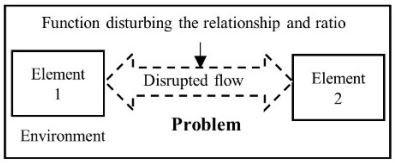
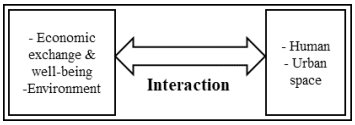
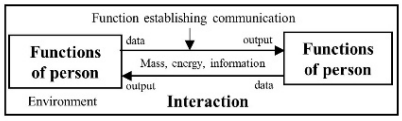


Fig. 1. Categorization of the categories of linkage and problem in axial coding (inductive content analysis). Source: Authors.

Table 2. Commonalities and differences of the linkage and problem category with the subcategories of communication, relationship, interplay, and interaction in selective coding. Source: Authors.

Subcategories of communication, relationship, interplay and interaction	**Modification of the theoretical model of communication, relationship, interplay and interaction subcategories**	**Modification of the theoretical model of linkage and problem category**
Communication (Lang, 1994, ix; Oxman, 1987, 4)	Communication (Authors based on Mohsenian Rad, 2020)	Linkage & Problem (Authors based on Nourmohammadzad, 2023, Baulberg et al., 1977; Churchman, 1983)
 The function mentioned in the definitions with the subject of communication is creation, but the function of establishing communication has not been mentioned.	 For example: the function established in auditory communication is hearing.	
Relationship (Kasprisin, 2020, 12; Relph, 2016, 229; Bahrainy & Bakhtiar, 2016, 6)	Relationship (Authors based on Nourmohammadzade, 2004)	
 The functions mentioned in the definitions with the subject of relationship are making, focusing, and relating but the function establishing relationship is not mentioned.	 For example: function establishing in a visual relationship is seeing.	
Interplay (DoE, 1994, 2; Carmona, 1996, 57 & 58, Madanipour, 1996, 104)	Interplay (Authors)	
 The functions mentioned in the definitions with the subject of interplay are checking and meaning, but the function establishing interplay is not mentioned.	 The function establishing a ratio of two components defines the degree of correlation between components.	
Interaction (Lara & Evans-Cowley, 2016, 264; Greed & Roberts, 2014, 6)	Interaction (Authors)	
 The functions mentioned in the definitions with the subject of interaction are supporting and concerning, but the function establishing interaction is not mentioned.	 The communication between person1 speaking to person2 becomes possible through perception.	

B-1- Communication is human-human.

B-2- The relationship can be human-non-human or non-human-non-human.

B-3- Interplay can be established between human-human, human-non-human, or non-human-non-human traits.

B-4- Interaction is a function establishing the relationship between the functions of two people, groups, or organizations.

B-5- Linkage refers to human-human, human-non-human, and non-human-non-human communication, relationship, interplay, interaction, or connection.

B-6- Disturbed human-non-human and non-human-non-human communication, relationship, interplay, interaction, or connection is considered a problem.

C: Function

Functions are actions causing communication, and relationship between components, as well as the ratio between the attributes of components (through interplay) and the semantic relationship between components in linkages. The functions occur through a process. In the problem (unhealthy linkage), functions disturb communication, relationships, or semantic relationships. There is an important point here, although the functions establishing communication, relationship, ratio, and semantic relationship have been mentioned in the subjects of communication, relationship, interplay, interaction, problem, and linkage, they have been discussed less.

D: Environment

In general systems theory in addition to the interactions between the parts, the system interacts with its environment as well (Fidanboy, 2022, 3; Oughton et al., 2018). The environment is not the subject of urban design. However, as mentioned earlier, the environment intermediates communication, relationship, ratio, and semantic relationship between the components in a linkage. This would not be possible without the environment. The existence of an environment is necessary for every communication, relationship, interplay, and interaction but it is one of the terms neglected in the definitions of urban design. The environment can include objective or subjective phenomena.

- **Modification of the theoretical linkage model**

In the theoretical linkage model, two components and the relationship between them are discussed. Quantitative and qualitative content analyses of the terms raised as subjects in urban design definitions were carried out along with supplementary investigations. Investigations showed that two groups of subjects have been discussed in urban design since its establishment:

1- Linkage and problem, Communication, relationship, interplay and interaction

2- The components of the linkage, between which communication, relationship, interplay, and interaction have been established at the levels of the concept, dimensions of the concept, and the components of the dimensions of the concept.

Considering the theoretical linkage model raised in the theories of general systems and complex systems, as well as the results of the content analysis, the theoretical linkage model was modified and presented in Fig. 2 In the most abstract form, the linkage consists of two components, communication, a relationship, an interlay, and an interaction between them through function(s) in the environment.

The modified linkage model was used according to the hierarchy principle. Each order is composed of a network of linkages (components, relationship, communication, interplay, and interaction among components through function(s) in the environment). The linkages in these networks are formulated with terms as follows:

- Linkage components are presented with terms either independently or together with other terms at three levels:

1. The concept level network such as building, space, etc.
2. The dimension level network such as the city environment, city body, city economy, etc.
3. The component level network, such as the physical form of the city, the elements of the city space, etc. Communication, relationship, interplay, and interaction between the mentioned terms have been established at the levels of concept, dimension, and component in the environment.

- Linkage has been established among the mentioned terms at the levels of concept, dimension, and component in the environment of the city through the functions of describing, explaining, predicting, and prescribing in the environment.

Therefore, it should be said that the networks of linkages of the different orders in the city system (according to the hierarchy principle) are the subjects of urban design. The linkages of the first order of the city are subjects and the linkages at lower orders are sub-subjects in urban design.

Conclusion

The etymology of the latent meanings of the terms raised as subjects in the definitions of urban design showed that each of them somehow implies the concept of linkage. Components (material and immaterial), communication, relationship, interplay and interaction, the functions establishing them, and the environment are semantically related to the concept of linkage. The problem is an unhealthy linkage. The environment intermediates the relationships between components. The results of the

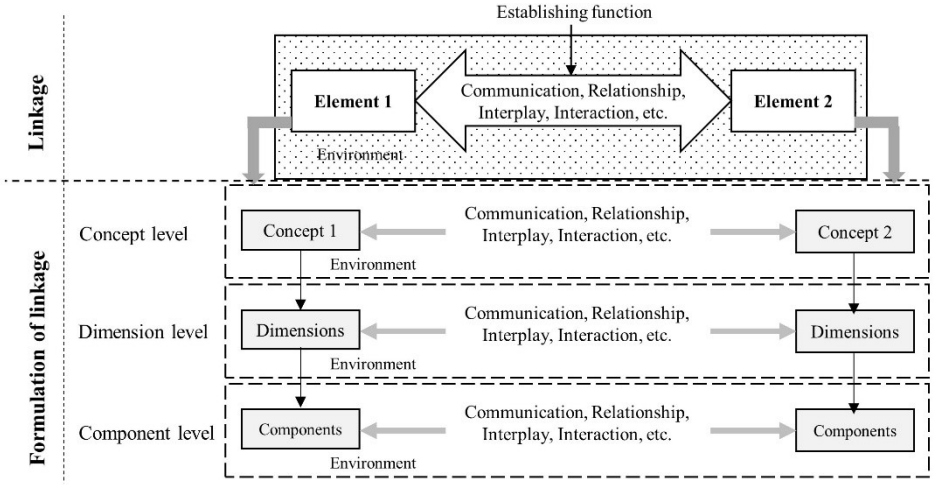


Fig. 2. The general theoretical linkage model and its formulation at the levels of concept, dimension, and component. Source: Authors according to Baulberg et al., 1977.

content analysis of the definitions of urban design showed that urban design subjects, along with the discussions relevant to the theoretical linkage model raised in the theories of general and complex systems, made it possible to remodify the concept of linkage in urban design. The remodified concept of linkage as a subject of urban design is very unique and distinct. Using the concept of linkage and considering the principle of the city system hierarchy, the linkage networks of its orders were defined and formulated. The formulated linkages at the first order of the city were urban design subjects and the formulated linkages at the lower orders were urban design sub-subjects. The content analysis of the terms raised as subjects in the definitions of urban design was very important and interesting because, firstly, it helped to modify the theoretical linkage model, and secondly, it answered the question: How can many urban design subjects be placed under the concept of linkage? Moreover, it provided the ground for raising many questions and explaining related hypotheses about the subject of urban design. Thirdly, it was found that urban designers and researchers are facing a network of subjects, not a single subject. Therefore, they need to determine the network of subjects before performing any design or research. Additionally, it seems that the concept of linkage can be used as a suitable tool in the interdisciplinary discussions of urban design. The modified linkage model can open new horizons in both theory and practice in urban design, which cannot be achieved except through further research.

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